IS 7820 (2004): Electrical Apparatus for Explosive Gas Atmospheres - Method of Test for Ignition Temperature [ETD 22: Electrical Apparatus for Explosive Atmosphere]

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IEC 60079-4 (1975)

भारतीय मानक

विस्फोटक गैस वातावरण के लिए विद्युत उपकरण – प्रज्वलन तापमान की परीक्षण पद्धति

(पहला पुनरीक्षण)

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES — METHOD OF TEST FOR IGNITION TEMPERATURE

(First Revision)

ICS 29.260.20

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2004

Price Group 6

NATIONAL FOREWORD

This Indian Standard (First Revision) which is identical with IEC 60079-4 : 1975 'Electrical apparatus for explosive gas atmospheres — Part 4 : Method of test for ignition temperature' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendations of the Electrical Apparatus for Explosive Atmospheres Sectional Committee and approval of the Electrotechnical Division Council.

This standard was first issued in 1975. The first revision of this standard has been undertaken to align it with corresponding IEC Standard.

Amendment No.1 to the above International Standard is given at the end of this publication.

The text of the IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following;

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Only the English text of the International Standard has been retained while adopting it as an Indian Standard, and as such the page numbers given here are not the same as in IEC Publication.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding of numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES — METHOD OF TEST FOR IGNITION TEMPERATURE

(First Revision)

1. Scope

This method of test is intended for use in the determination of the ignition temperature of a chemically pure vapour or gas in air at atmospheric pressure.

2. Definitions

For the purpose of this standard, the following definitions apply:

2.1 *Ignition temperature*

The lowest temperature at which ignition occurs when the method prescribed in this standard is followed.

2.2 *Ignition*

A reaction in the test flask which is evidenced by a clearly perceptible flame and/or explosion, and for which the ignition lag does not exceed 5 min.

2.3 *Ignition lag*

The period which elapses between the instant of completed injection of the sample and ignition.

3. Outline of method

A known volume of the product to be tested is injected into a heated open 200 ml Erlenmeyer flask containing air. The contents of the flask are observed in a darkened room until ignition occurs. The test is repeated with different flask temperatures and different sample volumes. The lowest flask temperature at which ignition occurs is taken to be the ignition temperature of the combustible in air at atmospheric pressure.

4. Apparatus

The test apparatus is described in the following sub-clauses:

4.1 *Test flask*

The test flask shall be a 200 ml Erlenmeyer flask of borosilicate glass. A chemically clean flask shall be used for tests on each product and for the final series of tests.

Where the ignition temperature of the test sample exceeds the softening point of a borosilicate glass flask, or where the sample would cause deterioration of such a flask, i.e. by chemical attack, a quartz or metal flask may be used, provided this is declared in the test report.

4.2 *Furnace*

The test flask shall be heated in an adequately uniform manner by a hot-air furnace. Examples of furnaces suitable for this purpose are described in Appendix A to this standard.

The test flask shall be deemed to be adequately uniformly heated and the position or positions selected for temperature measurement shall be deemed to be satisfactory if the measured ignition temperatures of the products in

Table I agree with the specified values within the tolerances given in Clause 7, when the test procedure of this standard is followed. The samples used for these checks shall have a purity of not less than 99.9%.

TABLE I

Product	Ignition temperature °C
n-Heptane	220
Ethylene	435
Benzene	560

4.3 *Thermocouples*

One or more calibrated thermocouples of 0.8 mm (0.032 in) maximum diameter shall be used to determine the flask temperature. The thermocouple(s) shall be positioned at selected points on the flask (see Sub-clause 4.2) and in intimate contact with its external surface.

4.4 *Sampling syringes or pipettes*

Liquid samples shall be introduced into the flask by means of either:

a) a 0.25 or 1 ml hypodermic syringe equipped with a stainless steel needle of 0.15 mm (0.006 in) maximum bore diameter, and calibrated in units not greater than 0.01 ml;

b) a calibrated 1 ml pipette allowing 1 ml of distilled water at room temperature to be discharged in 35-40 droplets.

Gaseous samples shall be introduced by means of a 200 ml gas-tight calibrated glass syringe fitted with a three-way stopcock and connecting tubes.

Note. — Precaution against flash-back should be taken. One method which has been used is illustrated diagrammatically in Figure 6 (see page 16).

4.5 *Timer*

A timer calibrated in one-second intervals shall be used to determine the ignition lag.

4.6 *Mirror*

It is recommended that a mirror should be suitably positioned approximately 250 mm above the flask to permit convenient observation of the interior of the flask.

5. Procedure

5.1 The temperature of the furnace shall first be adjusted to give the flask the desired uniform temperature.

5.2 *Sample injection*

When testing samples with boiling points at or near room temperature care shall be taken to maintain the temperature of the sample injection system at a value which will ensure that no change of state occurs before the sample is injected into the test flask.

5.2.1 *Liquid samples*

The required volume of the sample to be tested shall be injected into the test flask with the hypodermic syringe or pipette as appropriate. The sample shall be injected as droplets into the centre of the flask, as quickly as possible, so that the operation is completed in 2 s. The syringe or pipette shall then be quickly withdrawn. Care shall be taken to avoid wetting the walls of the flask during injection.

5.2.2 *Gaseous samples*

Gaseous samples shall be injected by first filling the gas-tight syringe and its associated tubes, making certain by repeated flushing that the system is completely filled with the gas to be tested. The required volume shall then be injected into the test flask at a rate of about 25 ml per second, keeping the rate of injection as constant as possible. The filling tube shall then be quickly withdrawn from the flask.

5.2.3 *Initial sample volume*

Suitable sample volumes for the initial tests are 0.07 ml for liquid samples and 20 ml for gaseous samples.

5.3 *Observations*

The timer shall be started as soon as the sample has been completely injected into the test flask and stopped immediately a flame is observed. The temperature and ignition lag shall be recorded. If no flame is observed, the timer shall be stopped after 5 min and the test discontinued.

5.4 *Subsequent tests*

The tests shall be repeated at different temperatures and with different sample volumes until the minimum value of the ignition temperature is obtained. Between each test the flask shall be flushed completely with clean dry air. After flushing, a sufficient time interval shall be allowed to ensure that the flask temperature is stabilized at the desired test temperature before the next sample is injected. The final tests shall be made in temperature steps of 2 deg C until the lowest temperature at which ignition occurs has been obtained.

5.5 *Confirmatory tests*

The final series of tests shall be repeated five times.

6. Ignition temperature

The lowest temperature at which ignition occurs in the tests described in Clause 5 shall be recorded as the ignition temperature, provided that the results satisfy the validity requirements of Clause 7. The corresponding ignition lag and the barometric pressure shall be recorded.

7. Validity of results

7.1 *Repeatability*

Duplicate results obtained by the same operator shall be considered suspect if they differ by more than 2%.

7.2 *Reproducibility*

The averages of duplicate results obtained in different laboratories shall be considered suspect if they differ by more than 5%.

Note. — The tolerances stated above for repeatability and reproducibility are tentative values pending the accumulation of more information.

8. Data

A record shall be kept of the name, source and physical properties of the combustible, test number, date of test, ambient temperature, pressure, quantity of sample used, ignition temperature and ignition lag.

APPENDIX A

FURNACES

Furnaces constructed in accordance with Clauses A1 and A2 below are suitable for the tests described in this standard.

A1 The furnace is shown schematically in Figures 1 to 6 (see pages 14 to 16).

It consists of a refractory cylinder, 127 mm (5 in) in internal diameter and 127 mm (5 in) long, circumferentially wound with a 1 200 W electric heater uniformly spaced along its length; a suitable refractory insulating material and retaining shell; a compressed asbestos-cement board cover ring and flask guide ring; a 300 W neck heater and a 300 W base heater.

Three thermocouples are used, positioned 25 mm (1 in) and 50 mm (2 in) below the bottom of the neck heater, and under the base of the flask near its centre.

The temperature measured by each of the thermocouples can be adjusted to within ± 1 °C of the desired test temperature by the use of independently variable controls for each of the three heaters.

A2 The furnace is shown schematically in Figures 7 to 9 (see pages 17 to 19). It consists of a resistance-heated furnace of approximately 1300 W, maximum heating current 6 A.

The heating wire, diameter 1.2 mm, length 35.8 m of (Cr/Al 30/5) alloy is circumferentially wound round the full length of a ceramic cylinder, with a turn spacing of 1.2 mm. The heater is fixed in position with high temperature mastic and enclosed by a thermally insulating layer of aluminium oxide powder 20 mm thick. A stainless steel cylinder is inserted in the ceramic body with the smallest possible clearance. The lid, covering the whole furnace, is also of stainless steel and holds the flask within the furnace. For this purpose, the lid consists of a top disk, a split asbestos gasket and a split lower disk. The neck of the flask is fitted into the lid with asbestos packing and is held by the segments of the split gasket and the lower disk, which are squeezed against it and fixed to the top disk by means of two ring nuts.

The heater may be operated on a.c. or d.c. with appropriate means of voltage control. The maximum heating current of about 6 A should be used to attain the temperature required for the preliminary tests. If an automatic temperature control system is used, the heating and cooling periods should be of equal length and if possible only a part of the heater current should be so controlled.

Measurement thermocouples are positioned on the outer-surface of the wall of the flask, 25 ± 2 mm from its base, and at the centre of the under-surface of the base.

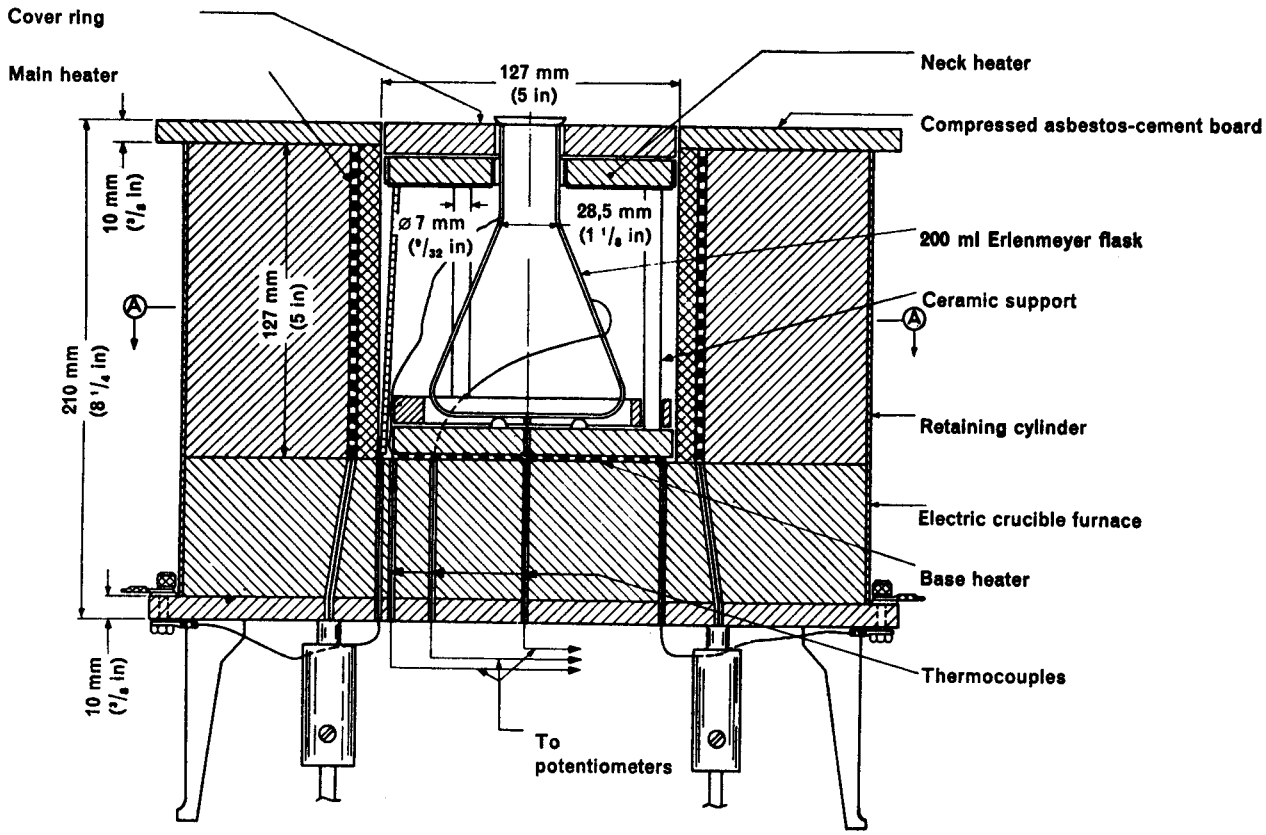


FIG. 1. — Test apparatus: assembly.

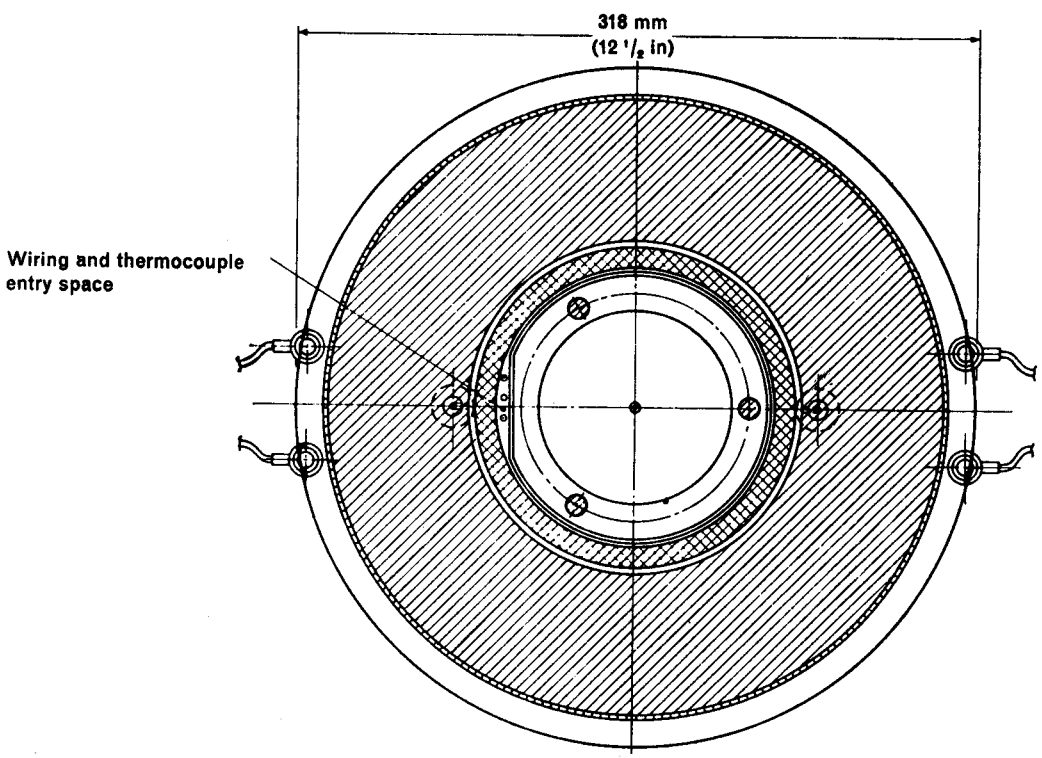


FIG. 2. — Section A-A (flask omitted).

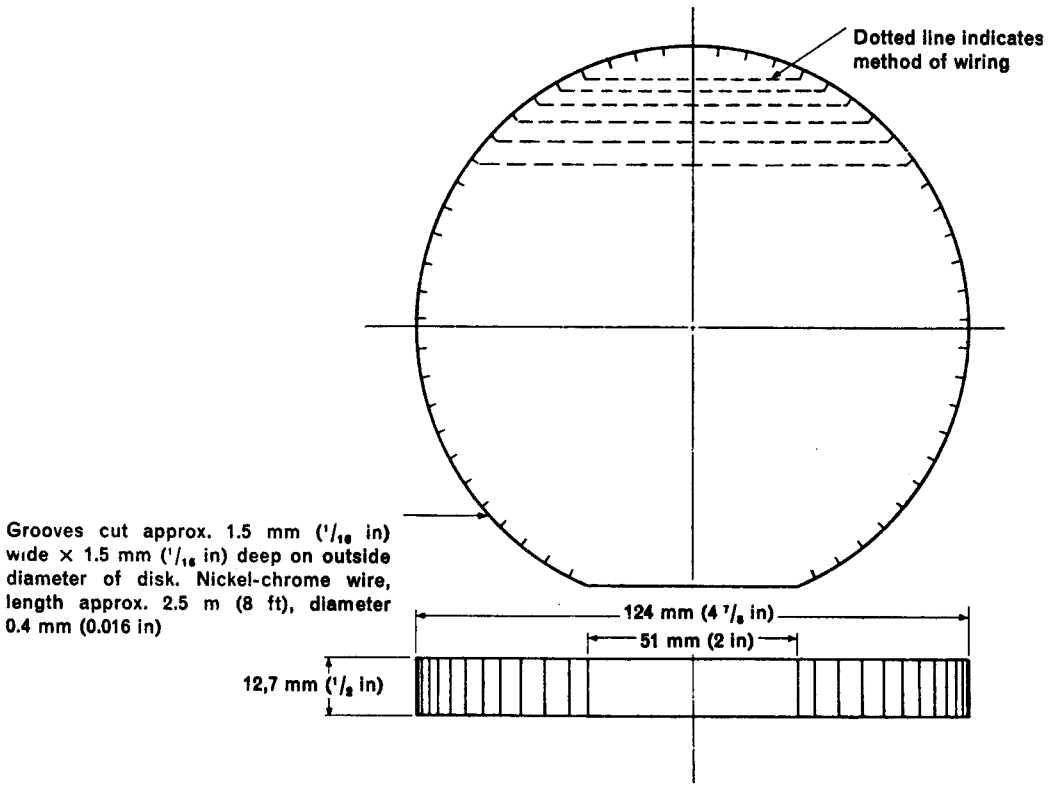


FIG. 3. — Base heater (compressed asbestos-cement board).

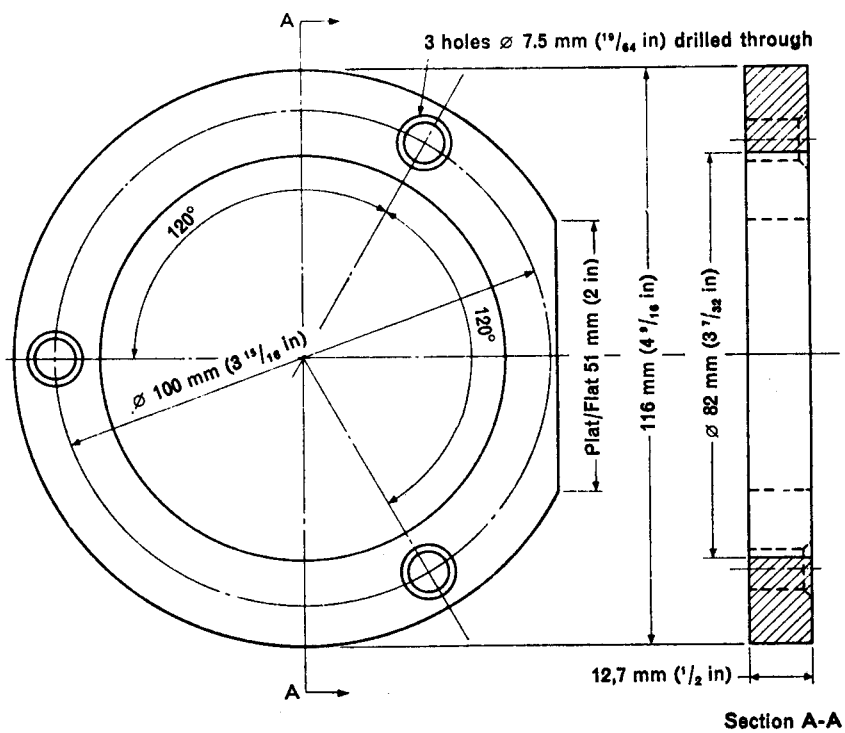


FIG. 4. — Flask guide ring (compressed asbestos-cement board).

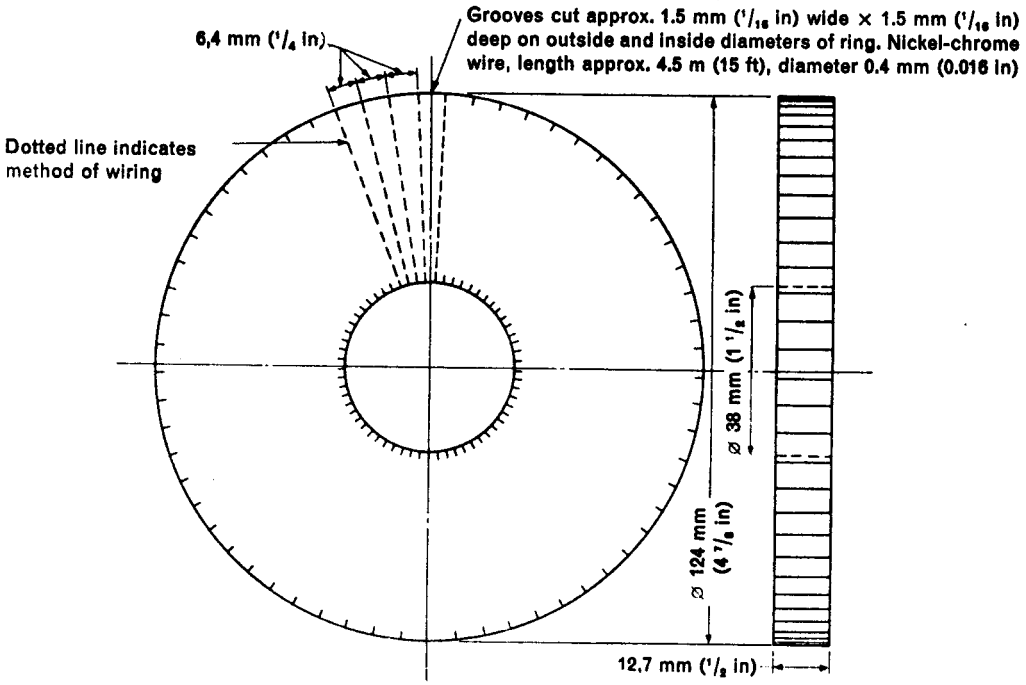


FIG. 5. — Neck heater (compressed asbestos-cement board).

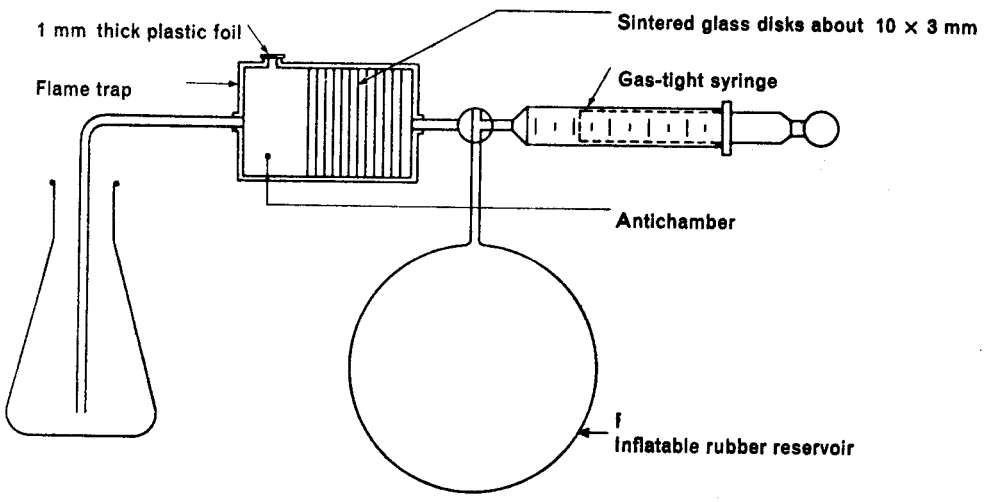
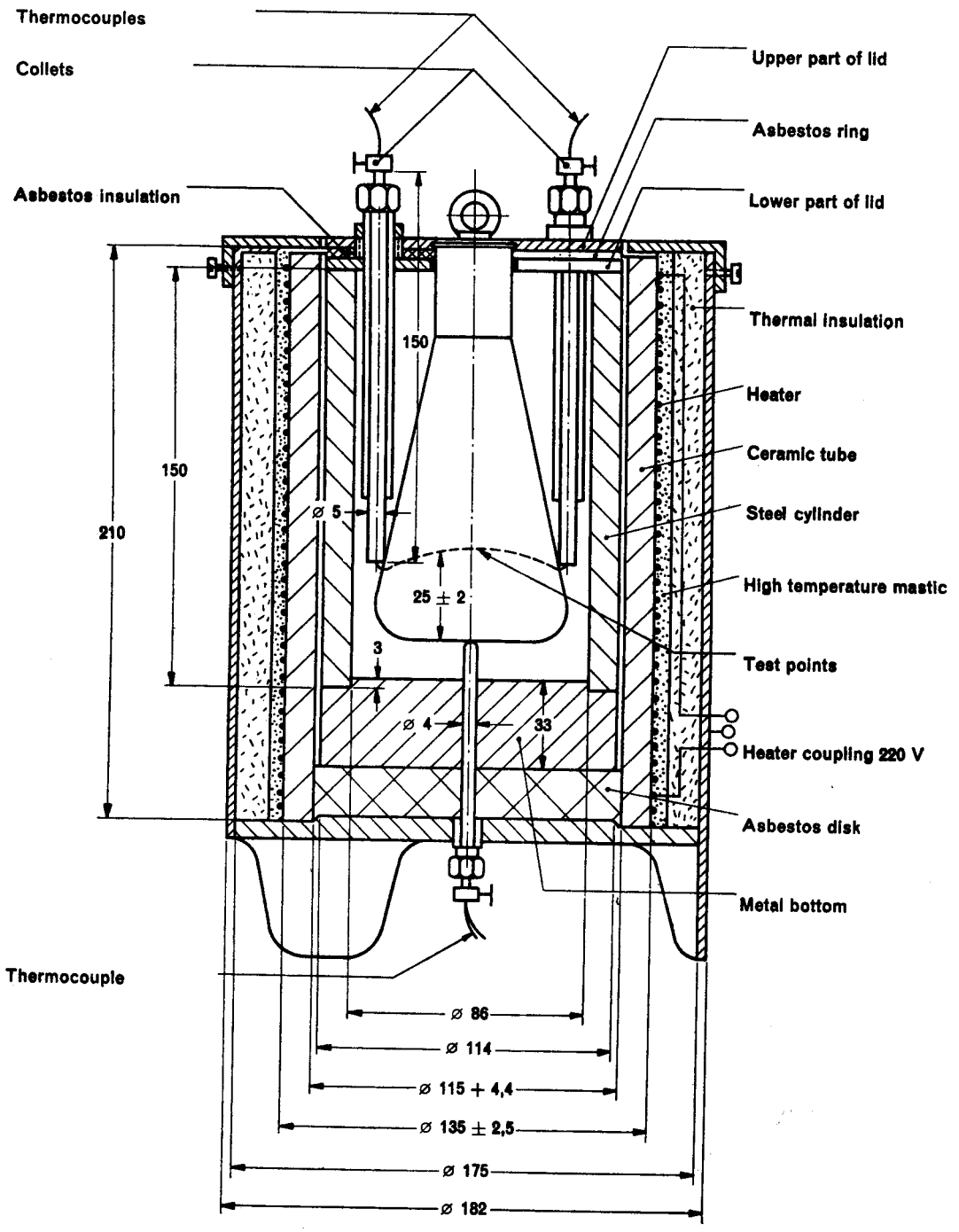
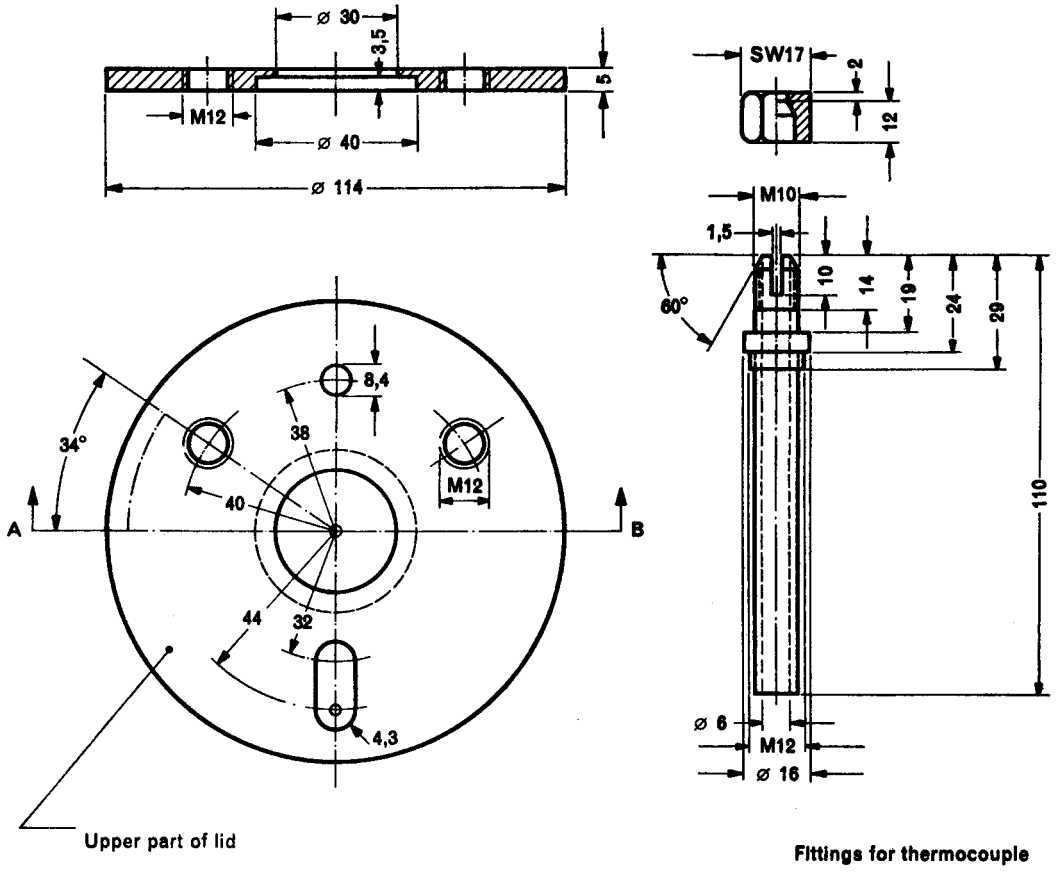


FIG. 6. — Injection of gaseous sample.



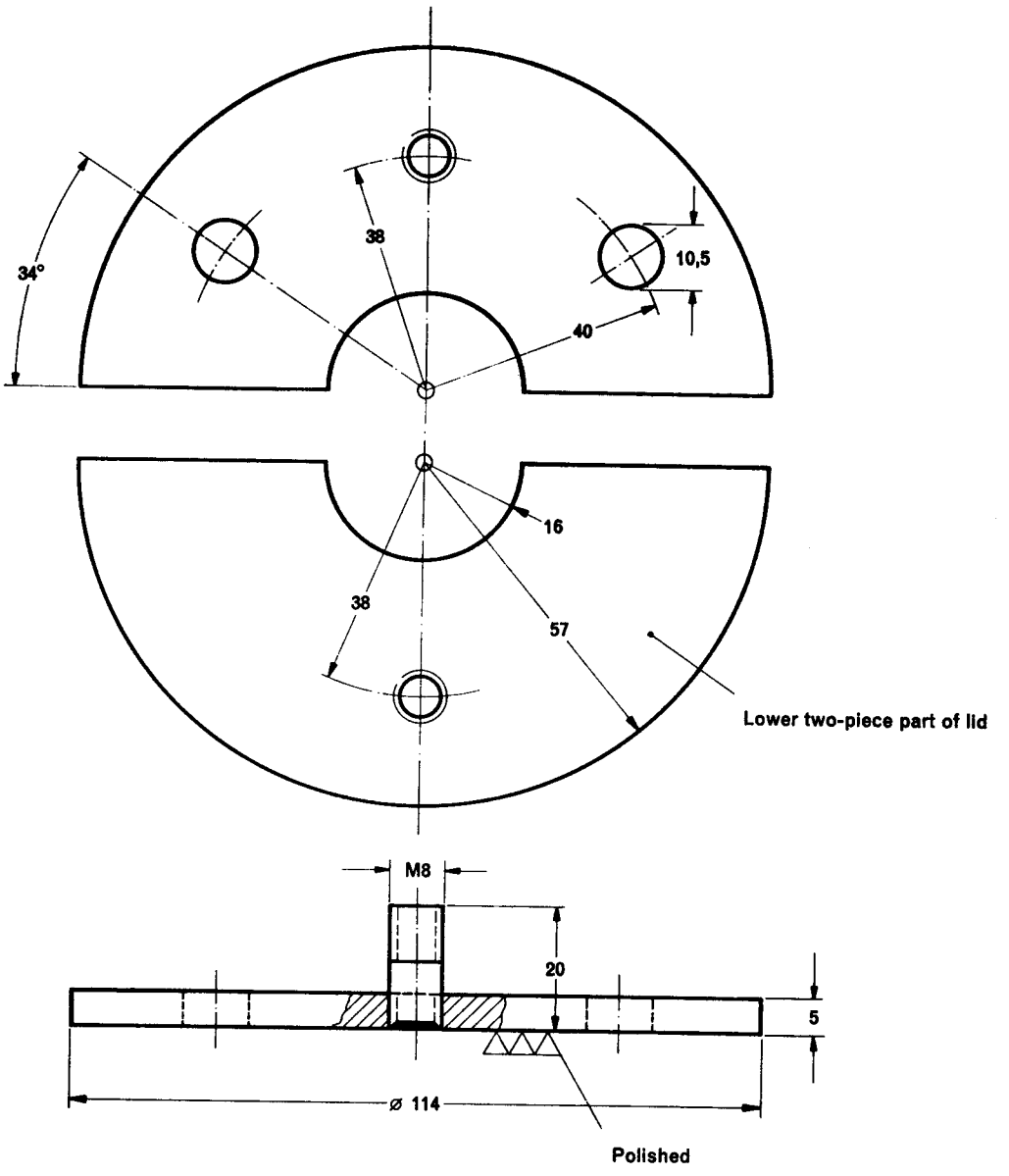
Dimensions in millimetres

FIG. 7. — Furnace.



Dimensions in millimetres

FIG. 8. — Lid of steel cylinder.



Dimensions in millimetres

FIG. 9. — Lid of steel cylinder.

Amendment 1

Page 13

Appendix A – Furnaces

A1

In the third line of the second paragraph, replace:

"a compressed asbestos-cement board cover ring and flask guide ring"

by the following:

"a cover ring and flask guide ring made from a board of refractory material".

A2

In the fifth line of the second paragraph, replace:

"a split asbestos" *by* "a split insulating".

In the sixth line of the second paragraph, replace:

"asbestos packing" *by* "heat insulating packing".

Page 14

Figure 1

Replace: "Compressed asbestos-cement board" *by* "Board of refractory material".

Pages 15 and 16

Figures 3, 4 and 5

In the titles, replace: "(compressed asbestos-cement board)" *by* "(board made of refractory material".

Page 17

Figure 7

replace: "Asbestos ring" *by* "Insulating ring", *replace:* "Asbestos insulation" *by* "Heat insulation"; *replace:* "Asbestos disk" *by* "Insulating disk".

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Review of Indian Standards

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